

Application No. 09/843,936  
Reply to Office action of May 5, 2003

### REMARKS/ARGUMENTS

Examiners Hien Tran and Jennifer Leung are specifically thanked for the courtesies extended during the interview of August 28, 2003. As noted in the Interview Summary sheet, rejections under 35 U.S.C. § 103 verses claims 31 and 35-40 were discussed. Specifically, the Applicant inquired as to specifically how Examiner Leung was proposing to Modify Japanese Reference 7-149670 in view of the U.S. reference 5,746,985. Essentially, the Examiner clarified that, in her opinion, it would be obvious to replace the consumption object 8 of the '670 reference with the reforming reactor 11, the hydrogen separating apparatus 14, the fuel cell 16, and the storage cell 18 shown in Figure 1 of the '985 reference. Also, the Examiner withdrew the rejection of claim 39 under 35 U.S.C. § 112, 2<sup>nd</sup> paragraph. These points will be further addressed below.

#### **Drawings**

The drawings have been objected to because the reaction equilibrium in Figure 2 is incorrect. In response, the Applicant has corrected the CO<sub>2</sub> designation and provided both a proposed drawing correction and a replacement drawing sheet. Applicant respectfully requests that the proposed drawing correction be approved and the corrected drawings entered into the file.

#### **Claim Objections**

Claim 40 has been objected to as being informal. Specifically, the Examiner suggested that "an internal combustion engine" on line 2 should be changed to "the internal combustion engine." In response, the Applicant has amended claim 40 as suggested. Therefore, Applicant respectfully requests that this objection be withdrawn.

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### Claim Rejections Under 35 U.S.C. § 112

Claim 39 was rejected under 35 U.S.C. § 112, 2<sup>nd</sup> paragraph as being indefinite. As mentioned above, this rejection was withdrawn during the interview. Applicant is grateful that this rejection was been withdrawn.

### Claim Rejections Under 35 U.S.C. § 103

Claims 31 and 35-39 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Eliasson et al. (DE 4332789 or JP 07-149670) in view of Takahashi (JP 07-315802 or U.S. 5,746,985 cited as English language equivalent). This rejection is respectfully traversed.

With regards to independent claim 31, the Examiner alleges that Eliasson et al. discloses an electrolyzer 3 supplied with water and electricity connected to a first reactor 4 which reacts with hydrogen and carbon dioxide to form methanol and a storage unit 7 connected to the first reactor 4 for storing the methanol and that the methanol may be supplied to a consumption object 8 such as vehicles and plants. The Examiner admits that the Eliasson et al. reference is silent as to the consumption 8 comprising a second reactor connected to a storage unit to receive methanol from the storage unit to convert methanol back into hydrogen carbon dioxide and to the system comprising a means for recycling the carbon dioxide produced in the second reactor to the first reactor 4.

The Examiner then notes that Takahashi teaches a reforming reactor 11, which the Examiner characterizes as a second reactor, and also discloses feeding the generated hydrogen/carbon dioxide stream into a hydrogen separating apparatus 14 wherein the purified hydrogen is separated for use as an energy source for a generator, such as a fuel cell 16. The Examiner correctly notes that Takahashi states that carbon dioxide and unrecoverable hydrogen are discharged.

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The Examiner then alleges that it would have been obvious for one of ordinary skill in the art at the time the invention was made to provide a second reactor to the apparatus of Eliasson et al. because a second reactor provides a means for utilizing the generated methanol as an energy source for fueling consumption objects such as a generator or fuel cell for vehicles as taught by Takahashi. The Examiner clarified during the interview that essentially it is considered obvious to replace the consumption device of Eliasson et al. with the reforming reactor 11, the hydrogen separating apparatus 14 and the fuel cell 16 of Takahashi. Once the substitution is made, the Examiner alleges it would be further obvious to one of ordinary skill in the art at the time the invention was made to provide an additional means for recycling the carbon dioxide generated by the second reactor to the first reactor. The Examiner does not state in the rejection where this means for recycling carbon dioxide is disclosed in the prior art. Upon questioning the point during the interview, the Examiner indicated it was simply known in the art to add such a means for recycling.

The Japanese reference 07-149670 or U.S. Patent No. 5,746,985 is actually directed to a method of storing energy from hydrogen by changing a mixture of hydrogen and carbon dioxide into methanol in a reactor and specifically is directed to the case where carbon dioxide is obtained from the exhaust gas of fossil fuel combustion energy generation equipment such as that found in a production plant (note plant 6). Essentially the carbon dioxide is recovered from the flue gas of the plant. For example, as shown in Figure 1, energy from the sun is transformed into electrical energy and used to disassemble water into hydrogen and oxygen in electrolysis equipment 3. The produced oxygen is provided for industrial purposes and presumably used within the plant. The hydrogen travels to a reactor 4. Additionally supplied to reactor 4 is carbon dioxide which initially is provided by burning fossil fuel such as coal, natural gas or petroleum. In the reactor, methanol is obtained from the hydrogen and carbon dioxide. The methanol is then stored in a tank where it can be supplied to a consumption object, such as the plant or vehicles. **No where does the prior art of record disclose a second reactor used to convert methanol back into hydrogen and carbon dioxide.** Reference is simply made to the methanol being burned or used as a fuel.

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Furthermore, there is no suggestion that any carbon dioxide produced when the methanol is consumed could or should be recycled to produce further methanol.

U.S. Patent No. 5,746,985 is directed to a reforming reactor. The reactor is designed to be light weight and compact and does not require an initial preheater. The reforming reactor is particularly suitable to be mounted on an electric automobile. See the discussion in column 3, lines 26-31. There is no mention in the Takahashi reference where the methanol used, comes from, or is made. Presumably, however, if this unit were a self contained unit in an electrical automobile, some sort of fuel tank would be provided to store the methanol.

Given the teachings in these references, the Applicant strongly objects to the Examiner indicating it would be obvious to replace consumption unit 8 with the reforming reactor arrangement of Takahashi in a plant environment. The unit in Takahashi is in a car and thus not analogous to a power plant. Furthermore, if Takahashi is used in a vehicle as suggested, it would be impossible to recycle the carbon dioxide. Instead, the carbon dioxide would be discharged to the atmosphere as specifically taught by Takahashi.

In any event, even if these two references are combined, no means for recycling is disclosed in the combination. **More specifically, no means for recycling from a second reactor to a first reactor is shown nor suggested.** That is, even if the concept of recycling carbon dioxide is known as the Examiner suggests, the prior art still would not anticipate or render obvious specifically recycling carbon dioxide from a second reactor to a first reactor as claimed in claim 31.

With respect to claims 35-40, Applicant respectfully submits that these claims are allowable for the same reasons as argued above regarding independent claim 31 by virtue of their dependency. However, Applicant submits that these claims are allowable in their own right. For example, claim 36 specifically recites a generator for receiving the hydrogen from the second reactor and generating electricity using the hydrogen. If

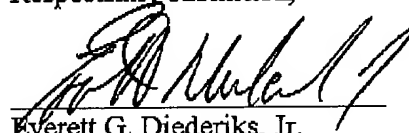
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methanol is used as fuel or is burned as suggested by Eliasson, no hydrogen is produced. Rather, combustion of methanol produces water. Therefore, with these limitations, there is considered to be another indicia of non-obviousness to combine the Takahashi and Eliasson references.

In a similar manner, claim 40 requires an internal combustion engine, with the second reactor providing hydrogen to the internal combustion engine. In response, the Examiner has argued that Eliasson should be modified in view of Takahashi in further view of Dennen, Jr. et al. (U.S. Patent No. 4,884,531). The Examiner alleges it would have been an obvious design choice to provide an internal combustion engine. It is unclear why it would be obvious to first convert a power plant by adding a reactor and fuel cell of a car and then add an additional internal combustion engine. There is simply no suggestion in the base references that hydrogen itself could be used as a fuel.

In view of the above remarks, and the amendments made to the drawings and the claims, it is respectfully submitted that the application should now be in clear condition for allowance such that allowance of all the claims and passage of the application issue is respectfully requested. If the Examiner should have any additional concerns regarding the allowance of this application, he is cordially invited to contact the undersigned at the number provided below if it would further expedite the prosecution of the application.

Respectfully submitted,



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